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An Investigative Study on Growth of Light of AlGaAs/GaAs in Nanotechnological Life Sciences

Pyare Lal

Department of Physics, Banasthali Vidyapith-304022 (Rajasthan) INDIA E-mail corresponding author: drpyarephysics@gmail.com

Abstract

In this exploring type research letter an investigative study on growth of modal confinement light gain of AlGaAs/GaAs type ternary nanomaterial in nanotechnological life sciences has been done by computational type nanotechniques under the number of NGILs (Nano Graded Index Layers). This type innovatively research letter provides a substantial contribution in nano type biological sciences because of their unique utilities. The spectral performances of growth of modal type light gain with energies of light photon in eV of AlGaAs/GaAs has been calculated and computed by spectral performances. In these spectral performances the peaks of spectra has been achieved at energy of photons ~1.5 eV correspondence wavelengths of light photons ~830 nm have been illustrated by appropriate graphical curves under various types of NGILs. Next the modal type behaviours of transparency energies of light photon of with different types of NGILs for proposed nano structure have been calculated by graphical results. Next, these types light of wavelengths ~ 830 nm have mostly been utilised in the optimization of a proper combination of higher penetrating abilities and cellular type interactions. Hence this wavelength's light source has also been used in the treatment of various sensitive type skin diseases in the nanotechnological biosciences and medical sciences.

Keywords: Growth of modal type light gain, Transparent type photon energy, Photon wavelength, NGILs, AlGaAs, GaAs

Introduction

The importance of heterogeneous type nanostructure in the nanotechnological sciences has been found to increasing order in recent time. In present time under the nanoscale type technological

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and engineering sciences the performances of heterogeneous type structures are very critical because of their unique optical light properties. The various types of experimental and theoretical research based innovative work in the all over world

have been done by the researchers. In several fields like medical science, industries, radar system, aerospace, photovoltaic and detectors areas, lasing type devices etc., the nanoscale type heterogeneous structures provide great role due to their several optical performances. The several types of optical properties of various nano scale type heterogeneous structures [1-5 and 17-18] have been investigated by the researchers. In general the heterogeneous type structures are formed by the process of combination of multiple hetero type junctions. The hetero type junctions are those junctions that are formed by interface between the dissimilar band gap nano materials. Among various nanoscale hetero type structures, the AlGaAs/GaAs nanotechnological materials have been very popular due to emission of radiations of ~ 830 nm wavelength. These type wavelengths have been of highly concern due to their potential performances in the fibre optic appliances based telecommunications due to diminish attenuation. These nanotechnological materials have been set up some additional reward such as gain stability at higher temperature, improved line width enhancement factor and photonic wavelength. The materials AlGaAs and AlGaInAs/InP [12-14] have also been reported as a platform on which the nanotechnological devices can be fabricated. For examples, the electrical results such as the I-V and C-V curves of the Schottky type diodes, which were fabricated on AlGaAs/GaAs nanotechnological materials, have been studied under the variations of barrier heights. In this paper an investigative study on growth of modal confinement light gain of proposed nanostructure in nanotechnological life sciences has been done by computational type nanotechniques under the number of NGILs. This research letter provides a substantial contribution in nano type biological sciences because of their unique utilities. The spectral performances of growth of modal type light gain with energies of light photon in eV of proposed nanostructure has been calculated and computed by spectral performances. In these spectral performances the peaks of spectra has been achieved at energy of photons ~1.5 eV correspondence wavelengths of light photons ~830 nm have been illustrated by appropriate graphical curves under various types of NGILs. Next the modal type behaviours of

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transparency energies of light photon of with different types of NGILs for proposed nanostructure have been calculated by graphical results. Next, these types light of wavelengths ~ 830 nm have mostly been utilised in the optimization of a proper combination of higher penetrating abilities and cellular type various interactions.

Computation and Theoretical Details

It has been clear that, now a day in the nanotechnological electronics and optical communication the yielding of optical gain [9-10, 15-16] has substantial role due its unique light properties. Commonly, the profit in optical light is given by yielding of light per unit original light intensity and per unit length of active region of structure. In the nano type optoelectronics optical type light yielding has been achieved when transitions of upward type are enhanced than transitions of downward type while in the equal condition of upward and downward transition the achieved yielding is negligible this type condition is termed as condition of transparent. When the power of absorption is higher than stimulated type emission then loss is obtained in the optical type light. An expression related with yielding of light gain as function of temperature and energy is give as below relation. This yielding gain equation is given by the reference [6].

$$G(E) = \frac{e^2 h}{2nEm_0^2\varepsilon_0 c}\left[1-\exp\left(\frac{E-\Delta f}{k_b T}\right)\right]$$
$$\times \sum_{nc,nv} \frac{|M_b|^2 f_c f_v}{4\pi^2 L_W} \times \frac{(h/2\pi\tau)dk_x dk_y}{\pi(\{E_{nc}+E_{nv}+E_{sg}\}-E)^2+(h/2\pi\tau)^2}$$

The modal type confinement parameter has critical role in the computing of yielding of modal confinement light gain per cm in the nanotechnological optical communications. The fundamental equation of modal type confinement parameter is given as following type relations.

$$\Gamma = \frac{\int_{-W/2}^{W/2} |\varepsilon(z)|^2 dz}{\int_{-\infty}^{\infty} |\varepsilon(z)|^2 dz}$$

The rate at which light gain varies with respect to carriers per unit volume is termed as differential type light gain. The equation of differential type gain is expressed as below relation.

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$$G^{'}(E)=\frac{dG(E)}{dN}=\frac{8\pi^{2}m_{r}E}{c\varepsilon h^{3}L_{w}}$$
$$\times\int_{E^{'}}^{\infty}\left|M_{b}\right|^{2}\left(\frac{df_{c}(E)}{dN}-\frac{df_{v}(E)}{dN}\right)L(E^{'})dE^{'}$$

The rate at which index of refraction has been changed with respect to carriers is called differential type index of refraction is shown by below equation.

$$n^{'}(E)=\frac{dn(E)}{dN}=\frac{4\pi^{2}m_{r}E\lambda\tau}{c\varepsilon h^{4}L_{w}}$$
$$\times\int_{E^{'}}^{\infty}\left|M_{b}\right|^{2}\left(\frac{df_{c}(E)}{dN}-\frac{df_{v}(E)}{dN}\right)(E^{'}-E)L(E^{'})dE^{'}$$

The parameter of antiguiding is expressed in terms of differential type index of refraction and differential type gain by below equation.

$$G^{'}=\frac{dG}{dN}=\frac{4\pi}{\lambda}\times\left(\frac{1}{\alpha}\right)\times\left(-\frac{dn}{dN}\right)$$

The equation of relaxation oscillation type frequency is exhibited by following equation. In this equation, the brief details of appropriate terms can be exhibited in refs [7, 8 and 11].

$$f_{r}=\frac{1}{2\pi}\times\left(\frac{(cP)}{(n\tau_{p})}\times\{G^{'}(E,N)\}\right)^{1/2}$$

The expression of threshold type current is given as below relation.

$$I_{th}=\left(\frac{nJ_{0}WL}{\eta}\right)\exp\left[\left(\frac{1}{n\Gamma G_{0}(J)}\right)\times\left(\alpha_{i}+\frac{1}{2L}\ln\frac{1}{R_{1}R_{2}}\right)-1\right]$$

Computational Results and Discussions

Basically, light increments are the net amount of the stimulated type emission that a photon generates as it travelled in given appropriate distance. In the hetero type nanostructures, the light amplification is caused by photon induced transition of electrons from the c-band to the v-band.

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If the rate of downward transitions exceeds the rate of upward transitions, there will be a net generation of photons and enhancement or profit in optical type gain [9, 10] can be achieved. The modal type gain enhancement per cm versus photonic wavelengths for various NGILs and peak modal gain enhancement in intensity of light per cm versus number of NGI-Layers of nanomaterial AlGaAs/GaAs type heterogeneous structure under the various number of NGILs have been illustrated by left y-axis and bottom x-axis; and right y-axis and top x-axis, respectively in fig1. The value of peak modal gain enhancement tends to higher value as reduce in number of

NGILs due to increase in value of parameter of modal confinement. The highest value of enhancement in intensity of modal type gain per cm is achieved at the wavelength of 830 nm. This range of wavelength of light has critical importance in the utilisation of NIR applications to achieve the combination of higher penetration power and cellular interaction performances without any type absorption losses. The achieved modal type gain results correspondence to maximum modal type light gain of wavelengths (~830 nm) for lasing phenomenon have an essential contribution in current days for the applications of EM radiations as well as this type wavelength range has been also useful in fibre optic telecommunications by the method of TIR with diminished losses and attenuations in dB/km of light signals. Moreover, the emitted light of 830 nm wavelength range has been used in the treatment of skin type deceases and this range also provides the contribution in the determination of correlation between higher value of penetration power and interaction of cellular in the medical sciences in daily life applications.

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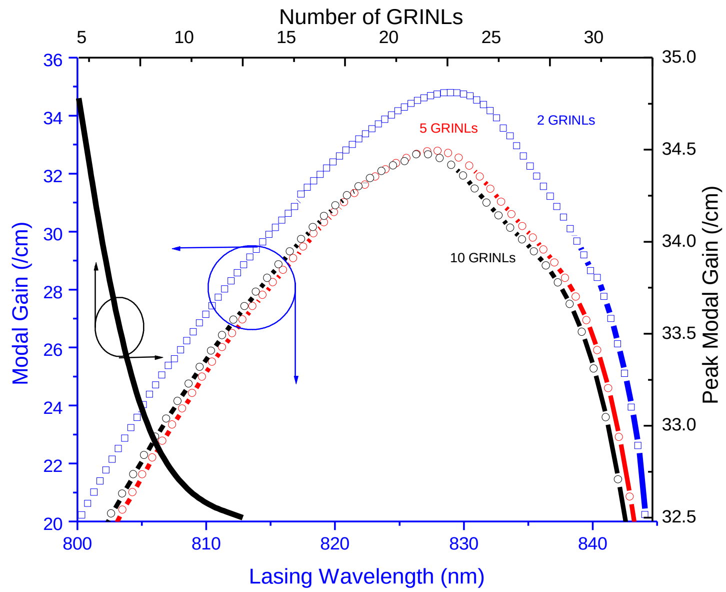

Figure1. Modal type gain intensity with photonic wavelength and peak modal type gain intensity with various NGILs for AlGaAs/GaAs

The compression in peak gain with various numbers of NGILs by left-y axis and bottom y- axis, and range of parameter of anti-guiding versus peak change in index of refraction by right y-axis and top x-axis for AlGaAs/GaAs type heterogeneous structure are shown

in fig 2. It has been cleared by fig 2 that the performances of peak type gain compression values have been reduced as increase in the number of graded refractive index nano layers i.e. the performances of peak type gain compression has reciprocal behaviour with the number of graded refractive index nano layers. And range of antiguiding parameter has also been reduced as enhancement in peak change in index of refraction i.e. range of auntiguiding parameter provides reciprocal performances with peak change in index of refraction. Hence, this types wavelength ~ 830 nm has been utilised in the optimization of a proper combination of higher penetrating abilities and cellular type interactions. Hence this wavelength's light source has also been used in

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the treatment of various sensitive type skin diseases in the nanotechnological biosciences, medical sciences and life sciences.

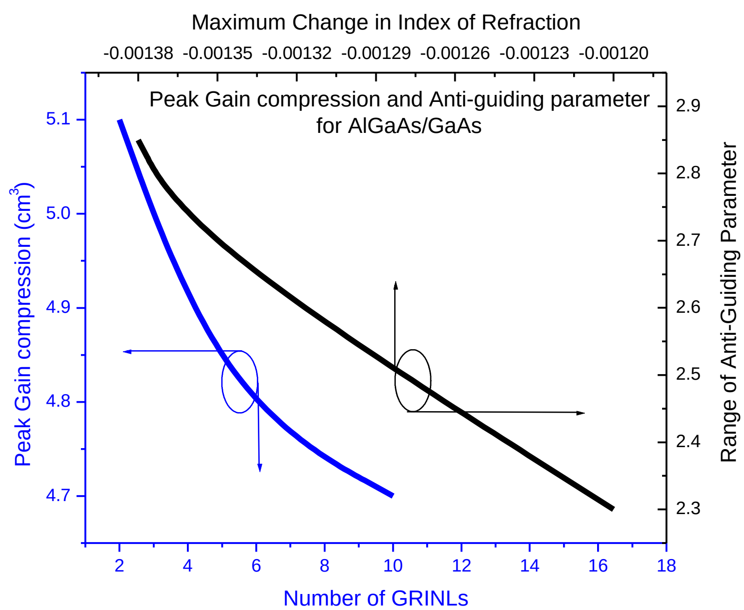

Figure 2. Compressional behaviour in peak gain with various numbers of NGILs and range of parameter of anti-guiding with peak change in index of refraction for AlGaAs/GaAs

Conclusions

Under the number of NGILs (Nano Graded Index Layers), in nanotechnological life sciences an investigative study on growth of modal confinement light gain of AlGaAs/GaAs type nanostructure has been done by computational type nanotechniques. This type innovatively research letter provides substantial contribution innano type biological sciences because of their unique utilities. The spectral performances of growth of modal type light gain with energies of light photon in eV of AlGaAs/GaAs has been calculated and computed by spectral performances. In these spectral performances the peaks of spectra has been achieved at energy of photons ~1.5

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eV correspondence wavelengths of light photons ~830 nm have been illustrated by appropriate graphical curves under various types of NGILs. The modal type behaviours of transparency energies of light photon of with different types of NGILs for proposed nano structure have been calculated by graphical results. These types light of wavelengths ~ 830 nm have mostly been utilised in the optimization of a proper combination of higher penetrating abilities and cellular type interactions. This wavelength's light source has also been used in the treatment of various sensitive type skin diseases in medical sciences and nanotechnological biosciences.

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